

CLAIMS

What is claimed is:

1. A semiconductor processing system, comprising:

a processing chamber operable to form a seed layer conformally over a barrier
5 layer, the barrier layer formed conformal to a trench and to a substrate located in the
chamber, wherein the trench is formed in the substrate; and

an x-ray scattering measurement system for measuring in-situ a thickness of
the seed layer at sidewall portions of the trench while the seed layer is being formed
and for providing a measurement signal indicative of the measured thickness.

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2. The system of claim 1, further comprising a control system for
controlling operating characteristics of the formation environment within the chamber,
the control system adjusting the operating characteristics to control formation of the
sidewall portions based on the measurement signal.

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3. The system of claim 2, further comprising a seed layer material
distribution system operable to conformally deposit seed layer material onto the
barrier layer to form the sidewall portions, the seed layer material distribution system
being controlled by the control system.

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4. The system of claim 1, wherein the measurement system is an x-ray
reflectometry system.

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5. The system of claim 4, wherein the x-ray reflectometry system includes
a polychromatic x-ray light source for generating a spectrum of incident angles at the
sidewall portions and a detector to measure an intensity of reflected x-rays as a
function of the incident angles.

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6. The system of claim 5, the detector transmitting the measured intensity
of the reflected x-rays with respect to the incident angles to a control system, the

control system being further adapted to generate a signature of the spectrum of reflectivity as a function of the incident angles that corresponds to the thickness of the sidewall portions.

5 7. The system of claim 6, further comprising a library of signatures corresponding to various thicknesses of the sidewall portions, the control system being adapted to search the library for a match to the generated signature to determine a thickness of the sidewall portions individually.

10 8. The system of claim 6, further comprising a library of signatures corresponding to various profiles of the sidewall portions, the control system being adapted to search the library for a profile match to the generated signature to determine a profile and a thickness of the sidewall portions.

15 9. The system of claim 6, wherein the control system controls a formation time period during which the sidewall portions are formed, the control system controlling the formation time period based on the determined thickness.

20 10. The system of claim 9, the control system generating a reflectivity signature component and scattering angle component corresponding to the sidewall portion thickness.

25 11. The system of claim 1, further including a display operatively coupled to the control system and operative to display a visual representation of the determined thickness of the sidewall portions during fabrication.

12. The system of claim 1, the seed layer being formed of a copper alloy such as copper-zinc, copper-aluminum, copper-zinc-aluminum, copper-nickel, copper-silver, copper-gold, copper-platinum and copper-paladium, or a combination thereof.

13. A method to facilitate formation of trench sidewall portions of a seed layer over a barrier layer conformal to a trench, comprising:

5 forming a seed layer conformal to the barrier layer, the barrier layer disposed conformal to the trench, wherein the trench is formed in the substrate;

reflecting a light beam of x-ray radiation at the sidewall portions of the seed layer;

generating a measurement signal based on the reflected portion of the light beam; and

10 determining substantial coverage of the sidewall portions by the seed layer based on the measurement signal while the sidewall portions are being formed at the trench.

14. The method of claim of 13, wherein determining substantial coverage comprises determining a thickness of the seed layer covering the sidewall portions.

15. The method of claim 14, further comprising adjusting operating characteristics of formation of the sidewall portions to control formation of the sidewall portions as a function of the determined thickness.

20 16. The method of claim of 14, further comprising adjusting operating characteristics of formation of the sidewall portions to control formation of the sidewall portions as a function of a determined profile.

25 17. The method of claim 13, further comprising generating a signature corresponding to the measurement signal.

18. The method of claim 17, further comprising comparing the generated signature with a library of signatures to determine the thickness of the sidewall portions.

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19. The method of claim 18, the generated signature and the library of signatures having a reflectivity signature component and a scattering angle component corresponding to the sidewall portion thickness.

5 20. The method of claim 19, further comprising controlling a formation time period based on the determined thickness.

PROPRIETARY MATERIAL
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